Mites of the genus *Calcarmyobia* (Acarina, Myobiidae) with information on the taxonomy of their host bats of the genus *Miniopterus* (Chiroptera, Miniopteridae)*

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Introduction

The tendency to regard the genus *Calcarmyobia* Radford as monotypic was prevalent until the beginning of the 1970s. The eight known species of the genus have been described on strict definition of each species (Uchikawa, 1982), and it is gradually proved that the mites of the genus *Calcarmyobia* are specific parasites of bats of the genus *Miniopterus*. Referring to the present knowledge of the mites, such formerly proposed specific names *Calcarmyobia miniopteris* and *C. parenzani* for species from South Africa and Europe, respectively, as well as some host records, should be revised (Uchikawa, 1984).

Mites of the genus *Calcarmyobia* have been evaluated as good indicators in the taxonomy and phylogeny of their host bats (Uchikawa & Harada, 1981). As the taxonomy of *Miniopterus* is not in a satisfactory state, an accumulation of records of the mites is believed to give a clue for solving some complicated problems in this area.

The present author had an opportunity to examine for ectoparasites the bat specimens deposited in the collections of the big museums in Europe and the United States. The present paper presents the records of the five species of the genus *Calcarmyobia* taken during the trip to add to the knowledge of the mites themselves and their host taxonomy.

The abbreviations for the museums, where the material dealt with in the present paper was collected, are as follows: AMNH—American Museum of Natural History, New York; BMNH—British Museum (Natural History), London; BSPM—Bernice P. Bishop Museum, Honolulu; FMNH—Field Museum of Natural History, Chicago; MNHN—Museum National d'Historie Naturelle, Paris; RMNH—Rijksmuseum van Natuurlijke Histoire, Leiden; SMF—Forschungs—Institut Senkenberg, Frankfurt.

Records of mites

Calcarmyobia rhinolophia (Radford, 1940)

Myobia rhinolophia Radford, 1940, *Parasitol.*, **32:** 91.
Calcarmyobia rhinolophia (Radford, 1940), Radford, 1952, *Bull. Mus. Hist. Nat., Paris.*, **24:** 371; Fain, 1978, *Ann. Mus. r. Afr. cent., (Sci. Zool.)*, **224:** 92; Uchikawa, 1982, *Annot. zool. Japon.*, **55:** 32.

This species was described originally on the material taken from a number of bats by G. H. E. Hopkins and T. H. E. Jackson in a cave at Kapretwa, Mt Elgon, Kenya (Radford, 1940). The host was given as 'a bat (*Rhinolophus lobatus* Peters)', but any bat of the genus *Rhinolophus* is not a true host of *Calcarmyobia*. With the guidance of Mr John Edwards Hill, Mammal Section, British Museum (Natural History), the present author located 2 series of bat specimens collected by Hopkins and Jackson at Kapretwa in 1938 and 1940. As Radford's manuscript dealing with *Myobia rhinolophia* was received for publication on 31 October 1939, the mites had presumably been obtained from the bats caught in 1938. The bats labelled *M. natalensis arenarius* with BMNH 1938.5.10.10–14 and 1938.5.10.4–9 for *Rhinolophus lobatus* yielded a male (1984.6.12.11)

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and 2 females (1984.6.12.10) of *C. rhinolophia*. Thus, a bat (*Rhinolophus lobatus* Peters) in Radford is better to be revised as *Miniopterus natalensis arenarius* Heller. In passing, the bats of the genus *Rhinolophus* are specific hosts of the mites of the genus *Neomyobia*, and Radford (1940) also described a *Neomyobia* under the name of *Myobia jacksoni* in the same paper.

The specimens of *C. rhinolophia* taken in the present study are listed in Table 1.

Table 1 Records of *Calcarmyobia rhinolophia* (Radford)

Codes No. Mites	BMNH Accession Number	Host	Locality	Host Accession Number
#79 1♀		*Miniopterus* sp.	Sudan	USNM 252716
#3 1♂1♀		*M. fuscus fraterculus*	Natal, S. Africa	AMNH 245207
#61 1♂3♀♀	1984.6.12.1–3	*M. inflatus africanus*	Kenya	BMNH 75.898–906
#45 2♂♂1N		*M. natalensis arenarius*	Mt Elgon, Kenya	FMNH 67958–65
#46 2♂♂3♀♀		*M. natalensis arenarius*	Mt Menengai, Kenya	FMNH 85467–78
#42 2♂♂5♀♀1N	1984.6.12.4–9	*M. natalensis arenarius*	Mt Elgon, Kenya	BMNH 36.3.16.13–20
#44 1♂2♀♀	1984.6.12.10–11	*M. natalensis arenarius*	Kapretwa, Mt Elgon	BMNH 1938.5.10.10–14*
#45 1♂1♀	1984.6.12.12–13	*M. natalensis arenarius*	Kapretwa, Mt Elgon	BMNH 40.726–37*
#65 2♂♂1♀1N		*M. schreibersi*	S. Sudan	FMNH 108169–70
#41 2♂♂2♀♀1N		*M. schreibersi arenarius*	Mt Menengai, Kenya	FMNH 91619–706
#36 1♂1♀	1984.6.12.14–15	*M. schreibersi arenarius*	Kenya	BMNH 70.726
#41 2♂♂3♀♀2N	1984.6.12.16–24	*M. schreibersi arenarius*	Mt Elgon, Uganda	BMNH 73.527–30
#47 1♂		*M. schreibersi arenarius*	Kenya	SMF 39425
#46 1♀	1984.6.12.25	*M. schreibersi natalensis*	Rhodesia	BMNH 54.1045
#3 1♂1♀1N		*M. schreibersi natalensis*	Zambia	AMNH 89780–3

*Specimens collected by Hopkins and Jackson.

Table 2 Records of *Calcarmyobia miniopteris* (Womersley)

Code No. Mites	BMNH Accession Number	Host	Locality	Host Accession Number
#105 3♀♀**		*Miniopterus* A	Timor	AMNH——
#148 1♂	1984.6.12.26	*M. australis minor*	S. Java	BMNH 9.1.5.428*
#164 1♂	1984.6.12.27	*M. medius*	Java	BMNH 9.1.5.462–3,5,6***
#187 2♀♀	1984.6.12.28–29	*M. fuliginosus*	Burma	BMNH 32.11.1.3
#188 1♀	1984.6.12.30	*M. fuliginosus*	India	BMNH 15.7.3.12
#38 3♂♂		*M. schreibersi*	Afghanistan	SMF 38828–30
#94 1♂	1984.6.12.31	*M. schreibersi*	China	BMNH 94.9.1.23
#91 1♂1♀	1984.6.12.32–33	*M. schreibersi*	Masuri, India	BMNH 79.11.21.177
#87 1♀	1984.6.12.34	*M. schreibersi*	India	BMNH 79.984–5
#98 1♀	1984.6.12.35	*M. schreibersi*	Ceylon	BMNH 59.5.31.66
#70 1♀		*M. schreibersi*	Thailand	USNM 294364
#1 1♂1♀		*M. schreibersi fuliginosus*	India	AMNH 208160
#61 3♂♂5♀♀		*M. schreibersi fuliginosus*	Katmandu, Nepal	SMF 58389–404
#120 1♀		*M. schreibersi fuliginosus*	Ceylon	USNM 277238–40
#155 1♀	1984.6.12.36	*M. schreibersi japoniae*	Japan	BMNH 6.1.4.22*
#55 1♂		*M. schreibersi parvipes*	China	AMNM 44656*

*Type specimen, **Tentatively identified, ***Specimens with the same data as those of the type of *M. medius* (BMNH 9.1.5.4624) yielded also 2 other species of *Calcarmyobia*.

Calcarmyobia miniopteris (Womersley, 1941)

Myobia miniopteris Womersley, 1941, *Rec. S. Aust. Mus.*, **7:** 52.
Calcarmyobia rhinolophia (Radford, 1940), Radford, 1952, *Bull. Mus. Hist. Nat., Paris*, **24,** 371.
Calcarmyobia japonica Uchikawa, 1976, *Annot. zool. Japon.*, **4:** 56.
Calcarmyobia miniopteris (Womersley, 1941), Fain & Lukoschus, 1979, *Rec. West Aust. Mus.*, **7:** 72.

Calcarmyobia miniopteris (Womersley) was once synonymized with *C. rhinolopia* (Radford), but its validity was proved in 1976 by the present author, though he dealt with it as a new species. The specimens taken in the present study are shown in Table 2 and in the distribution map, Fig. 9. A male taken from the type of *M. australis minor* that has been synonymized with *M. paululus* by Maeda (1982) is thought to be a stray specimen. This will be mentioned again in the next paper.

Calcarmyobia congoensis Uchikawa, 1982

Calcarmyobia congoensis Uchikawa, 1982, *Annot. zool. Japon.*, **55:** 36.
Calcarmyobia rhinolophia (Radford, 1940), Lawrence, 1951, *Ann. Natal. Mus.*, **12:** 103.
Myobia miniopterus Womersley, 1941, Lavoipierre, 1946, *J. Entomol. Soc. S. Afr.*, **9:** 78.

Calcarmyobia congoensis Uchikawa was described from 4 male and 2 female specimens from *Miniopterus,* which were not satisfactorily identified (Ukchikawa, 1982). This species is closely allied to *C. rhinolophia* (Radford). The males of both species are, however, easily separable from each other by the structure of the genital shield and by the nature of *gp* on the shield. Compared with the inflated *gp* of *C. rhinolophia,* the seta is fine and setiform on the type specimens of *C. congoensis.*

In the present study are some 90 male specimens of the mites, which have the genital shield essentially the same in structure to that of the type specimens of *C. congoensis.* All the above specimens and their partner females have been identified as *C. congoensis,* but the particular seta *gp* shows a remarkable variation in thickness. The seta is typically setiform as in Fig. 1a on some specimens, but is obviously thickened as in Figs 1b and 1c on others. Contrary to such the clear differences in the males, the partner females of both the forms are barely separable by the nature of some setae. The striated basal part of setae d_1 and d_4 is slightly shorter on the partner females of the typical males than on those of the atypical males, and, thus, the outline of that part is

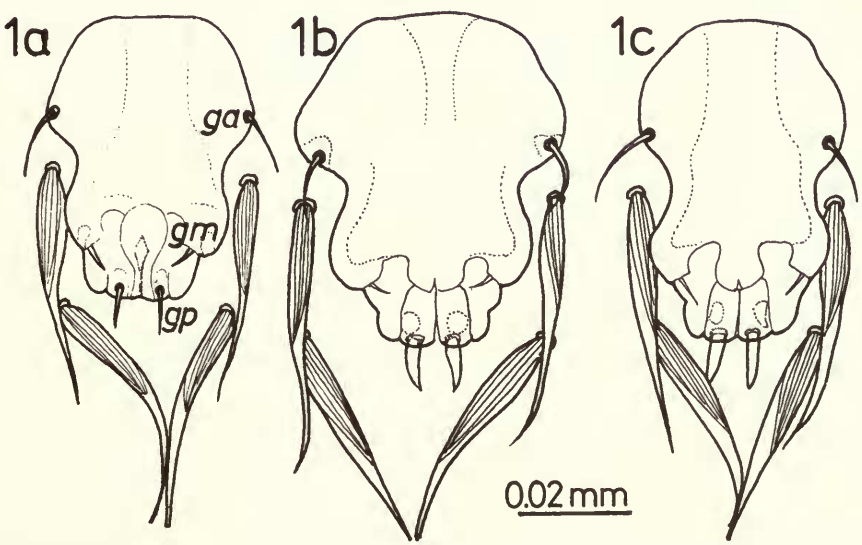


Fig. 1 Variation in thickness of the setae *gp* on the male of *Calcarmyobia congoensis* Uchikawa: typical (1a); atypical (1b & c) forms.

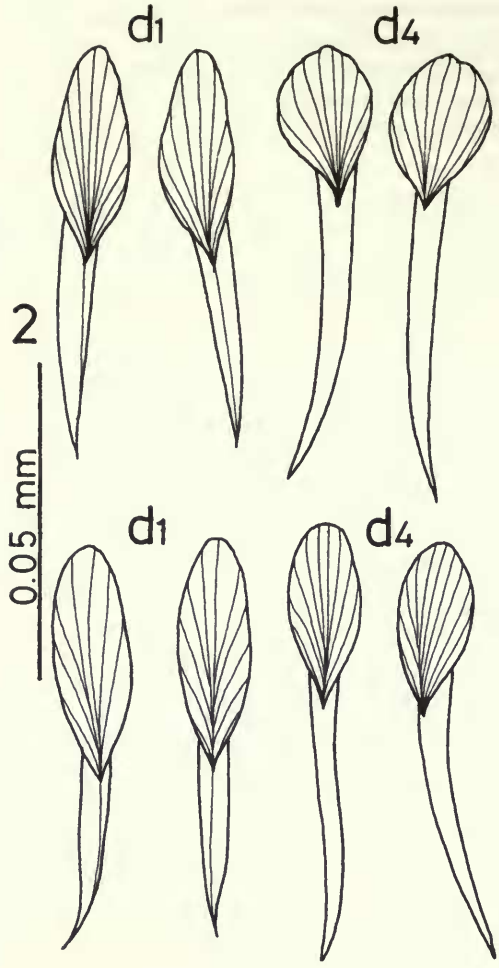


Fig. 2 Differences in the dorsal setae, d_1 and d_4, on the female of *Calcarmyobia congoensis* Uchikawa: typical (upper); atypical (lower) forms.

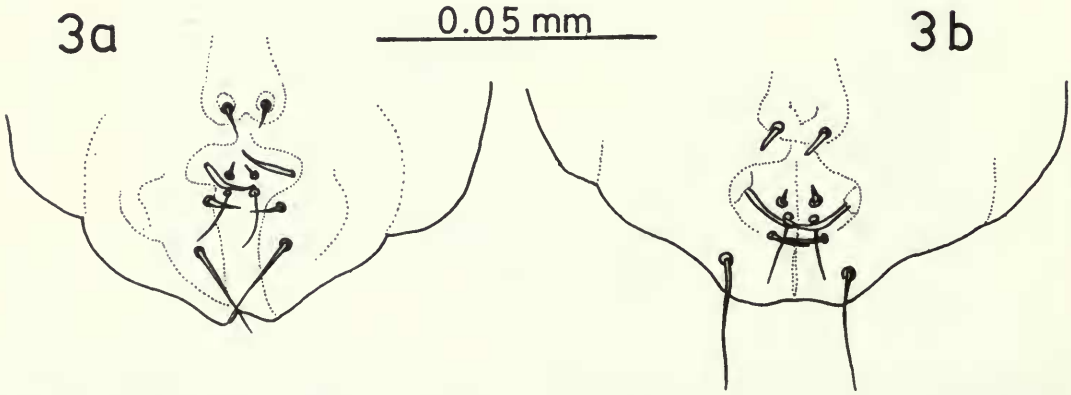


Fig. 3 Difference in the internal anal setae, *ai*, on the female of *Calcarmyobia congoensis* Uchikawa: typical (3a); atypical (3b) forms.

somewhat different in the two forms as depicted in Fig. 2. The anal seta *ai* is usually less prominent on the typical form than on the atypical form as shown in Fig. 3. According to these subtle differences in both sexes, the two forms of *C. congoensis* taken in the present study are recorded separately in Tables 3 and 4. Although both forms of the mites are regarded as being conspecific in the present study, the host and locality records in Tables 3 and 4 may be useful in consideration of the distribution pattern of the host bats and in their phylogenetic relationships.

Calcarmyobia congoensis seems to be prevailing in the Ethiopian region excluding the western part, where data are still wanting, and in Madagascar (Fig. 9). The typical form was taken frequently from the bats from the central to western parts of Africa, and the atypical form from those from Ethiopia to South Africa and just into eastern Africa. There was, however, no strict geographical segregation in the distribution of both the forms. As to the host bats, the type host of *C. congoensis, Miniopterus* from Congo (MNHN 25-05-69) is not yet properly identified. Among the host bats of the typical form in Table 2, only *M. villiersi* seems to be one of the true hosts of the mite. Some other host bats are still anonymous or to be reconfirmed as discussed later. On the other hand, the type specimens of *M. africanus, M. breyeri, M. dasythrix* and *M. scotinus* harboured the atypical form of *C. congoensis* and these species are regarded as the true hosts of the mite with the additional data in Table 3. *Miniopterus natalensis* and *M. smitianus* are also thought to be the true hosts of the atypical form of *C. congoensis*.

Lavoipierre (1946) and Lawrence (1951) recorded *Myobia miniopterus* Womersley and *C. rhinolophia* (Radford), respectively, from *M. natalensis* in Transvaal and Natal, South Africa. Their mites have not been re-examined referring to the present knowledge of *Calcarmyobia,* but it

Table 3 Records of *Calcarmyobia congoensis* Uchikawa, typical form

Code No. Mites	BMNH Accession Number	Host	Locality	Host Accession Number
#79 1♀		*Miniopterus* sp.	Sudan	USNM 252716
#16 1♀		*Miniopterus* sp.	Central Africa	MNHN —
#17 1♂1♀		*Miniopterus* sp.	Central Africa	MNHN —
#18 1♂2♀♀		*Miniopterus* sp.	Central Africa	MNHN —
#19 2♂♂2♀♀		*Miniopterus* sp.	Central Africa	MNHN —
#24 3♂♂1♀		*Miniopterus* sp.	Cameroun	MNHN —
#39 1♂2♀♀		*Miniopterus* sp.	Angola	FMNH 84125–37
#62 1♂1♀		*M. fraterculus*	Angola	FMNH 83601
#66 1♂	1984.6.12.37	*M. inflatus*	Belg. Congo	BMNH 59.512
♀62 1♂	1984.6.12.38	*M. inflatus africanus*	Belg. Congo	BMNH 59.513–5
#22 3♂♂7♀♀		*M. inflatus africanus*	Kenya	USNM 351059
#34 6♂4♀♀		*M. natalensis*	Mozambique	USNM 365448–52
#33 1♂		*M. natalensis*	Rhodesia	USNM 368613–4
#63 1♀		*M. natalensis*	Rhodesia	USNM 95156–7
#173 1♂2♀♀	1984.6.12.39–41	*M. schreibersi*	Angola	BMNH 4.4.9.25–6
#175 1♀	1984.6.12.42	*M. schreibersi*	Belg. Congo	BMNH 95.7.16.2
#52 2♂♂2♀♀		*M. schreibersi*	Zambia	SMF 48029–37
#49 2♀♀		*M. schreibersi arenarius*	Sudan	FMNH 68106–8
#55 11♂2♀♀		*M. schreibersi arenarius*	Kenya	SMF 19862–3
#169 1♀	1984.6.12.43	*M. schreibersi arenarius*	Kenya	BMNH 10.4.1.27
#56 4♂♂2♀♀		*M. schreibersi natalensis*	Katanga, Zaire	SMF 21300–9
#57 2♂♂3♀♀		*M. schreibersi natalensis*	Katanga, Zaire	SMF 19072–8
#47 2♀♀		*M. schreibersi natalensis*	N. Rhodesia	FMNH 96270–1
#55 1♂	1984.6.12.44	*M. schreibersi natalensis*	Zaire	BMNH 74.512–6
#84 4♀♀	1984.6.12.45–48	*M. schreibersi villiersi*	Cameroun	BMNH 68.647
#85 2♂♂	1984.6.12.49	*M. schreibersi villiersi*	Cameroun	BMNH 68.330–1
#165 1♀	1984.6.12.50	*M. schreibersi villiersi*	Cameroun	BMNH 60.106–7
#66 1♂3♀♀		*M. schreibersi villiersi*	Cameroun	FMNH 42587–90
#10 1♂2♀♀		*M. schreibersi villiersi*	?	AMNH 49321

is highly probable that they had dealt with the same species of mite. The mite is thought not to be other than the atypical form of *C. congoensis* from Tables 3 and 4.

Calcarmyobia dusbabeki nom. nov.

Calcarmyobia rhinolophia (Radford, 1940), Dusbábek, 1963, *Acta. Soc. ent. Céchoslov.*, **60:** 248; Uchikawa, 1976, *Annot. zool. Japon.*, **49:** 57; Fain & Aellen, 1979, *Rev. suisse Zool.*, **86:** 218.

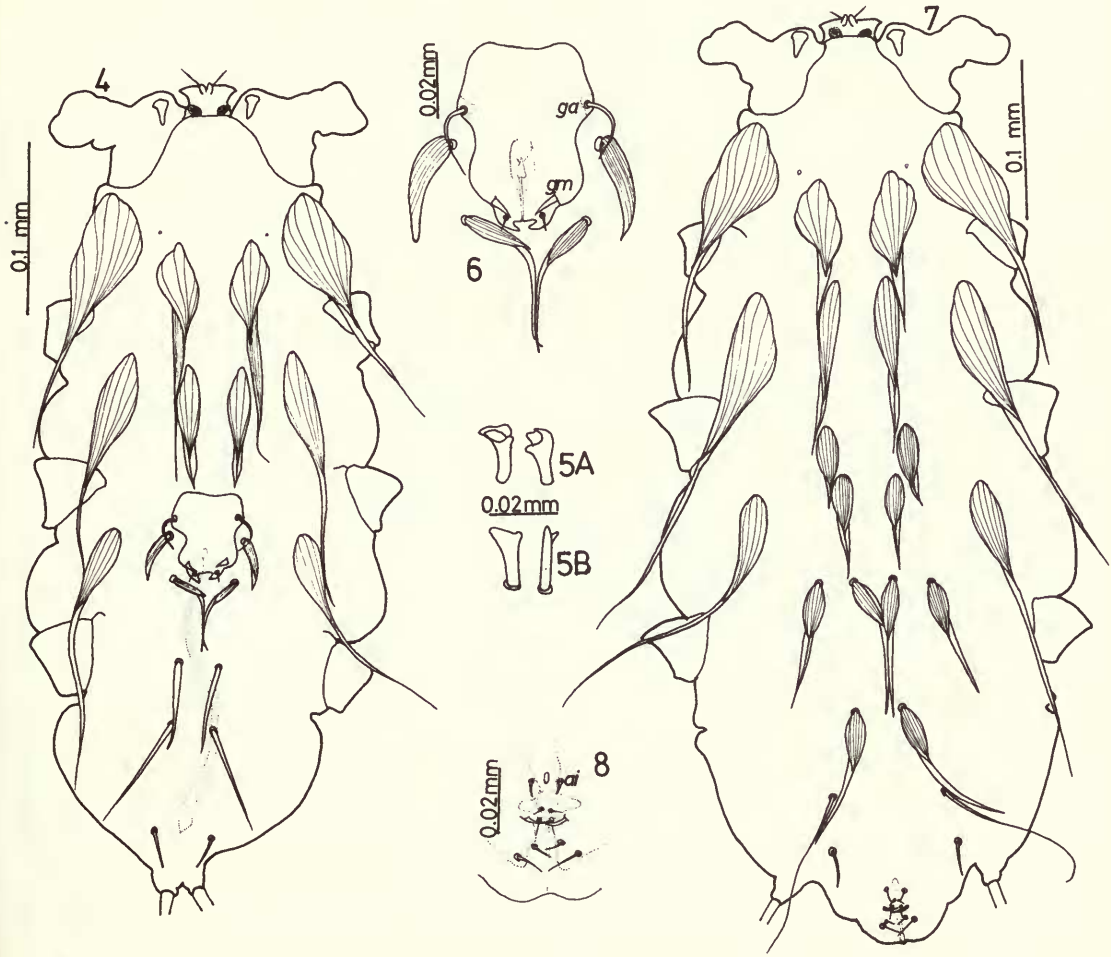
?Calcarmyobia parenzani Lombardini, 1956, Fain & Aellen, 1979, *Rev. suisse Zool.*, **86:** 218; Fain & Lukoschus 1979, *Rec. West Aust. Mus.*, **7:** 70: *Uchikawa, 1982, Annot. zool Japon.*, **55:** 35.

Table 4 Records of *Calcarmyobia congoensis* Uchikawa, atypical form

Code	No. Mites	BMNH Accession Number	Host	Locality	Host Accession Number
#80	1♂		*Miniopterus* sp.	Rhodesia	USNM 154587
#83	1♂2♀♀		*Miniopterus* sp.	Transvaal	USNM 237550–4
#61	2♂♂2♀♀3N		*M. africanus*	Ethiopia	FMNH 28765,–7–8,770*
#185	1♂	1984.6.12.51	*M. africanus*	Big Abbai	BMNH 28.1.11.29–30
#182	1♂3♀♀	1984.6.12.52–55	*M. breyeri*	Transvaal	BMNH 9.7.2.3–5,7–8
#150	1♀	1984.6.12.56	*M. breyeri*	Transvaal	BMNH 9.7.2.6*
#122	2♂♂2♀♀		*M. breyeri vicinior*	Aba, Zaire	AMNH 49021,–25
#2	2♀♀		*M. breyeri vicinior*	Aba, Zaire	AMNH 49031
#14	4♂♂ 11♀♀22N		*M. dasythrix*	Caffrérie, S. Africa	RMNH 25093*
#18	2♂♂2♀♀		*M. fraterculus*	Transvaal	USNM 342641
#19	1♂2♀♀		*M. fraterculus*	S. Africa	USNM 381629,–32–4
#6	4♀♀		*M. fuscus fraterculus*	Mozambique	AMNH 216228
#44	1♂1♀		*M. inflatus*	Kenya	SMF 43660
#63	3♂♂	1984.6.12.57–59	*M. inflatus africanus*	Ethiopia	BMNH 70.492
#65	2♀♀	1984.6.12.60	*M. inflatus africanus*	Ethiopia	BMNH 72.246–87
#71	1♂2♀♀	1984.6.12.61–63	*M. inflatus africanus*	Ethiopia	BMNH 71.606–15
#24	1♂2♀♀		*M. inflatus africanus*	Kenya	USNM 436816–35
#4	1♂1♀		*M. minor fraterculus*	S. Africa	AMNH 116091
#47	1♂	1984.6.12.64	*M. natalensis*	Transvaal	BMNH 49.722
#48	5♂♂1♀	1984.6.12.65–70	*M. natalensis*	S. Africa	BMNH 52.1364–74
#51	1♀	1984.6.12.71	*M. natalensis*	Rhodesia	BMNH 62.2099–100
#53	1♂	1984.6.12.72	*M. natalensis*	Transvaal	BMNH 51.729–32
#54	1♂1♀	1984.6.12.73	*M. natalensis*	Natal	BMNH 51.21–6
#119	1♀		*M. natalensis*	Natal	AMNH 245208
#152	3♀♀		*M. natalensis*	Transvaal	BSPM 145607–8
#62	1♀		*M. natalensis*	Kenya	USNM 317129–28
#67	1♂		*M. natalensis*	Kenya	USNM 166591,–93
#92	2♂♂6♀♀	1984.6.12.74–81	*M. schreibersi*	Transvaal	BMNH 9.7.2.27–8
#65	4♂♂3♀♀		*M. schreibersi*	S. Africa	USNM 479536–7
#40	3♀♀	1984.6.12.82–83	*M. schreibersi arenarius*	Ethiopia	BMNH 72.4447–8
#46	1♂		*M. schreibersi arenarius*	Ethiopia	SMF 45735
#31	1♂1♀		*M. schreibersi arenarius*	Kenya	FMNH 182697
#36	1♀		*M. schreibersi natalensis*	Transvaal	USNM 156337
#37	1♂2♀♀		*M. schreibersi natalensis*	Transvaal	USNM 221423–30
#21	2♂♂8♀♀		*M. schreibersi natalensis*	Botswana	RMNH 30694
#23	3♂♂7♀♀		*M. schreibersi natalensis*	Botswana	RMNH 30693
#38	2♂♂		*M. schreibersi natalensis*	S. Africa	USNM 376762
#40	1♀		*M. schreibersi natalensis*	S. Africa	USNM 381599–606
#58	1♂		*M. schreibersi natalensis*	Transvaal	SMF 44807
#151	1♀	1984.6.12.84	*M. scotinus*	Caffraria, S. Africa	BMNH 46.6.2.19*
#174	2♀♀	1984.6.85	*M. scotinus*	Salisburg, Rhodesia	BMNH 95.7.16.1–2
#171	1♂1♀	1984.6.12.86–87	*M. smitianus*	S. W. Africa	BMNH 35.1.6.41–2
#172	1♂2♀♀	1984.6.12.88–90	*M. smitianus*	S. W. Africa	BMNH 35.9.1.83

*Type specimen(s).

The mite of the genus *Calcarmyobia* found in Europe was first identified as *C. rhinolophia* (Radford) by Dusbábek (1963), and, then, was proved to be a species distinctly different from the Japanese form, based on the definite criteria for differentiating species of *Calcarmyobia* (Uchikawa, 1976). Fain & Lukoschus (1979) suggested that *C. parenzani,* inadequately described by Lombardini (1956), might probably become valid as representing the populations parasitizing *M. schreibersi* in Europe. Uchikawa (1982) once followed them, but is now of the opinion that *C. parenzani* Lombardini does not represent the genus *Calcarmyobia,* and that the mite should be named on the designation of the type specimens (Uchikawa, 1984). In the present study, the specimens were found on the bats from Romania, the type locality of *M. schreibersi.* A brief description of *C. dusbabeki* nom. nov. is given below based on these specimens as the types.



Figs 4–8 *Calcarmyobia dusbabeki* nom. nov.: male dorsum (4); modified claw on leg II (5a); modified seta on tibia II (5b); genital shield and setae d_1 and d_2 (6); female dorsum (7); genito-anal setae (8).

MALE (Figs 4, 5 & 6). Setae *vi* tapering; d_1 flattened. Genital shield bearing spiniform *gm,* which are situated close to terminal lobes; genital pore slightly anterior to level of *gm.* Modified claw on leg II and modified seta, *al,* on genu II as in Fig. 5. A ventral seta on tarsus II long and thick.

Measurements in μm for holotype and, in parentheses, for two paratypes. Body (gnathosoma+ idiosoma) 470 (470–490) long by 210 (215–220) wide. Setae *ve* 145 (140–133); *vi* 138 (?–140); *sc e* ?(160–165);

Table 5 Records of *Calcarmyobia dusbabeki* nom. nov.

Code No. Mites	BMNH Accession Number	Host	Locality	Host Accession Number
#51 4♂♂4♀♀2N		*M. schreibersi*	Afghanistan	FMNH 110911–3
#11 5♀♀		*M. schreibersi*	Ukraina, USSR	AMNH 244266
#37 2♂♂3♀♀2N		*M. schreibersi*	Afghanistan	SMF 38835–9
#53 1♂1♀		*M. schreibersi*	Tunisia	SMF 22221–31
#88 3♀♀	1984.6.12.91–93	*M. schreibersi*	Tunisia	BMNH 79.918–24
#101 1♀	1984.6.12.94	*M. schreibersi*	Syria	BMNH 46.247
#103 4♀♀	1984.6.12.95–96	*M. schreibersi*	Iran	BMNH 14.39–41
#105 1♂3♀♀1N	1984.6.12.97–100	*M. schreibersi*	Iran	BMNH 14.26–38
#145 1♂7♀♀36N	1984.6.12.101–109	*M. schreibersi pallidus*	Iran	BMNH 7.7.14.7*
#28 2♂♂3♀♀		*M. schreibersi*	Algeria	RMNH 28528
#16 1♂1N		*M. schreibersi*	Algeria	RMNH —
#31 3♂♂2♀♀1N		*M. schreibersi*	Rumania	RMNH 28708–14

*Type specimen.

Table 6 Records of *Calcarmyobia kenyaensis* Uchikawa

Code No. Mites	BMNH Accession Number	Host	Locality	Host Accession Number
#84 2♂♂2♀♀1N		*Miniopterus* sp. (2spp.?)	Kenya	USNM 351247–59
#154 1♂2N	1984.6.12.110–111	*M. inflatus*	Cameroun	BMNH 3.2.4.8*
#70 1♂	1984.6.12.112	*M. inflatus*	Liberia	BMNH 79.520
#40 2♂♂2♀♀		*M. inflatus*	Katanga, Congo	SMF 21310–2
#41 1♀		*M. inflatus*	Belg. Congo	SMF 18926–7
#42 1♂2♀♀		*M. inflatus*	Kenya	SMF 39423–4
#17 2♀♀		*M. inflatus africanus*	Kenya	USNM 351014–5
#23 3♂♂1♀1N		*M. inflatus africanus*	Kenya	USNM 351040–1
#9 1♂1♀1N		*M. inflatus rufus*	Uganda	AMNH 184358–9
#45 1♂		*M. natalensis arenarius*	Kenya	FMNH 67958–65
#97 1♂	1984.6.12.113	*M. schreibersi*	Belg. Congo	BMNH 60.112
#47 2♂♂		*M. schreibersi arenarius*	Kenya	SMF 39425
#28 2♂♂1♀		*M. schreibersi arenarius*	Kenya	USNM 436845–58
#31 3♀♀		*M. schreibersi arenarius*	Kenya	USNM 182697

*Type specimen.

sc i 73 (75–77); d_1 35 (30–35); d_2 45 (43–44); d_3 50 (43–45); l_1 160(165–165); l_3 70 (?–?). Genital shield 53(50–53) long; *ga–ga* 37(37–38). Setae *al* on genu II 18(18–20) long.

FEMALE (Figs 7 & 8). Setae d_1 terminating abruptly; its membraneous tail shorter than proximal striated part. Setae on genito-anal region as in Fig. 8; g_5 distinctly shorter than g_7; *ai* setiform.

Measurements in μm for allotype and a paratype. Body 590–605 long by 270–260 wide. Setae *ve* 168–165; *vi* 105–105; *sc e* 188–190; *sc i* 108–107; d_1 53–38; d_2 63–78; d_3 90–95; d_4 90–98; l_1 200–202; l_2 85–90; d_1–d_1 50–50; d_2–d_2 30–30; d_3–d_3 22–23; l_2–l_2 70–73.

TYPES. Holotype male, allotype female, 2 paratype males and a paratype female ex *Miniopterus schreibersi*, cave near Tirgussor, Romania, 24-May-1971 (RMNH 28708–14). The types are deposited in the collection of RMNH.

The other specimens of *C. dusbabeki* nom. nov. examined in the present study are listed in Table 5. This mite was found only on *M. schreibersi* from the circum-Mediterranean regions east

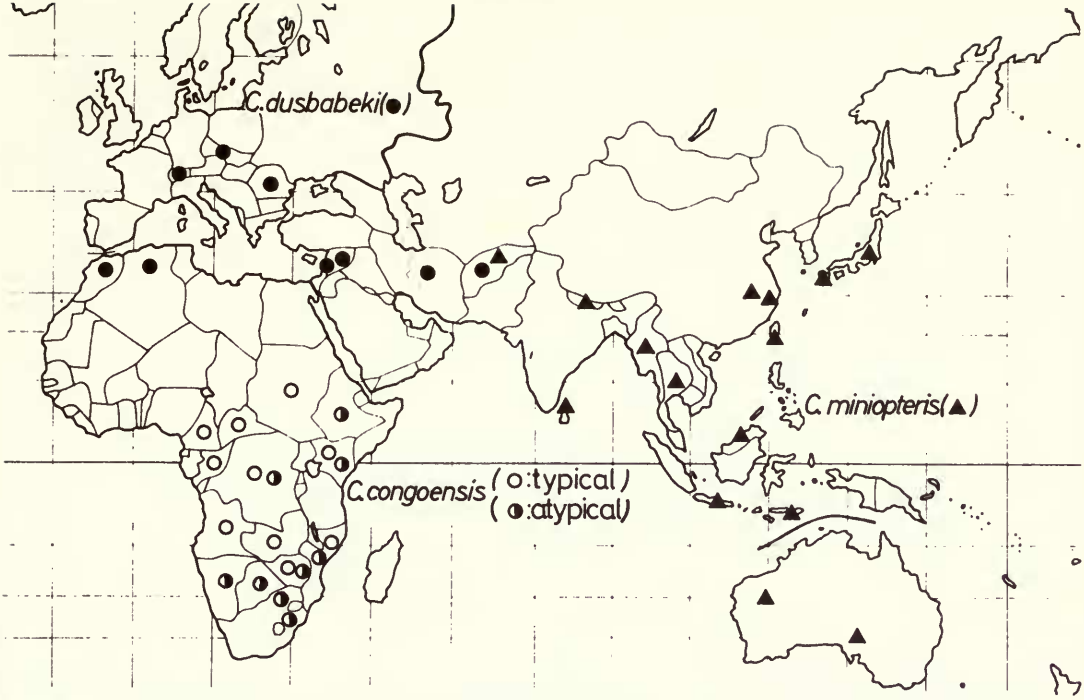


Fig. 9 The distribution of *Calcarmyobia dusbabeki* nom. nov., *Calcarmyobia miniopteris* (Womersley, 1941) and *Calcarmyobia congoensis* Uchikawa, 1982.

to Afghanistan, where the distribution of the mite met that of *C. miniopteris* (Tables 2 & 5). The distribution map of *C. dusbabeki, C. congoensis* and *C. miniopteris* based on the present data and those in Uchikawa (1983) is shown in Fig. 9. It is noteworthy that *C. dusbabeki* nom. nov. is closer to *C. congonensis* and other Ethiopian mites described than to *C. miniopteris*, the representative in the eastern Palearctic, Oriental and Australasian regions, in having the genital setae *gm* on the genital shield and an inflated ventral seta on tarsus II in the male.

Calcarmyobia kenyaensis Uchikawa, 1982

Calcarmyobia kenyaensis Uchikawa, 1982, *Annot. zool. Japon.*, 55: 37.

This mite was originally described as a parasite of *Miniopterus inflatus* from Kenya. Further records obtained in the present study are presented in Table 6. These include a male found on the type skin specimen of *M. inflatus* in the BMNH.

Discussion

The solutions to the three problems concerning the known species of the genus *Calcarmyobia* (Uchikawa, 1984) have been obtained in the present study. The first is that the host of *C. rhinolophia,* the generic type, is presumed to be *Miniopterus natalensis arenarius*. The second is that records of *Myobia miniopterus* and *C. rhinolophia* from *M. natalensis* in South Africa (Lavoipierre, 1946; Lawrence, 1951) are now thought to be the atypical form of *C. congoensis*. Finally, the well known but unnamed *Calcarmyobia* distributed in Europe has been described and type specimens designated.

The geographical distribution of some mites of the genus *Calcarmyobia* has been further established with accumulation of the data in the present study. *Calcarmyobia congoensis* with a

remarkable intraspecific variation prevails in almost the whole of the Ethiopian region on various bats, inclusive of the types of *M. africanus, M. breyeri, M. dasythrix* and *M. scotinus*, as shown in Tables 3 and 4. *Calcarmyobia dusbabeki* nom. nov. is, on the other hand, distributed in the western Palearctic region east to Afghanistan, where it meets with *C. miniopteris* occurring in the eastern Palearctic, Oriental and Australasian regions (Fig. 9). Data for *C. rhinolophia* and *C. kenyaensis* are still fragmentary, yet ranges for these mites seem not to be so wide as those of the above species. Such limited distribution pattern of the mites may suggest groupings of their host bats.

The host bats of the five mite species considered in this paper are recorded in Tables 1 to 6 according to the labels in the respective collections. As the mites of the genus *Calcarmyobia* are oligoxenic and not synhospitalic (Uchikawa & Harada, 1981), it is likely for a mite to parasitize all subspecies of a bat, and for a host bat to harbour only a single species of the mites. Many host records in the tables are, however, against this rule. The present author expects that information deduced exclusively from the mites will draw attention to contradictory points in the host taxonomy.

Miniopterus schreibersi appears in all tables, suggesting a most unsatisfactory definition of this species. The mite *C. dusbabeki* parasitic on *M. schreibersi* in Europe, the type locality of the bat, has a rather limited range only in the western Palearctic region as shown in Table 5 and Fig. 9. It is therefore reasonable to regard *M. schreibersi* and its close relatives, the hosts of *C. dusbabeki,* as the bats distributed in a range similar to that of their common parasite. If this is the case, *schreibersi* in Tables 1–4 and 6 will need to be revised.

As shown in Table 1, *M. natalensis arenarius* is thought to be the true holst of *C. rhinolophia,* while *M. natalensis* is one of the common hosts of *C. congoensis* as seen in Tables 3 and 4. Although *C. rhinolophia* and *C. congoensis* are very close to each other, reflecting a close affinity among their hosts, it is improbable that different subspecies of a bat would harbour specific mites of the genus *Calcarmyobia*. Thus, *arenarius* originally described as a subspecies of *M. natalensis* should be elevated to a full species or be transferred to a subspecies of a species other than *M. natalensis*.

M. africanus, the paratypes of which yielded the atypical form of *C. congoensis*, is sometimes ranked as a subspecies of *M. inflatus* (Tables 3 & 4). As the type and other specimens of *M. inflatus* frequently harboured *C. kenyaensis* (Table 6), *M. inflatus* is believed to be a true host of *C. kenyaensis,* and, then, the host of *C. congoensis* should not be treated as a subspecies of the host bat of *C. kenyaensis*.

All six tables contain host records that are contradictory to our main premise. Some mites might have been transferred to the wrong hosts before the present author examined them, and, in some cases, misidentification might have been made for some bats even in the collections of the leading museums.

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